AMERICAN JOURNAL OF PHARMACY

AND THE SCIENCES SUPPORTING PUBLIC HEALTH

Since 1825

COMMITTEE ON PUBLICATION

E. Fullerton Cook, Sc. D., Ph. M. Mitchell Bernstein, M. D. J. W. Sturmer, D. Sc.
John K. Thum, Ph. M. Louis Gershenfeld, Ph. M., D. Sc. Joseph W. E. Harrisson, Ph. M.

IVOR GRIFFITH, Ph. M., Sc. D., Editor
Linwood F. Tice, M. Sc., Assistant to the Editor
John E. Kramer, B. Sc., Business Manager

Vol. 112. SEPTEMBER, 1940 No. 9

CONTENTS

Editorials:

"Women in Pharmacy" 354

Pharmacy Week 356

Original Articles:

A Toxicological Investigation of Certain Alkaloids. By B. A. Acena and L. W. Rising 357

A Suggestion for a U. S. P. Test for Olive Oil to Eliminate Teaseed Oil. By Wallace H. Dickhart 371

The Action of High Frequency Sound Waves on Bacteria. By D. P. LeGalley and G. W. Patterson 373

Abstracts from, and Reviews of, the Literature of the Sciences Supporting Public Health 378

Book Review 384

Annual Subscription, $3.00 **Foreign Postage, 25 Cents Extra**

Single Numbers, 30 Cents **Back Numbers, 50 Cents**

Entered as Second-Class Matter at the Post Office at Philadelphia, Pa., Under the Act of March 3, 1879

Acceptance for Mailing at Special Rate of Postage Provided for in Section 1103 Act of October 3, 1917. Authorized February 15, 1920

EDITORIAL

On these pages the editor offers his opinions, unshackled by advertising patrons and unrestrained by anything save a sense of the decent and the truthful. The editor, alone, is responsible for their type, their tone and their tenor.

"WOMEN IN PHARMACY"

Place: Philadelphia.

Time: July 2d, a few decades ago.

Dramatis Personae: The Old Fogeys and Fuss-pots of the then Philadelphia Medical Society.

Occasion: The Proposed Establishment of the *Female* Medical College in Philadelphia.

Minutes of the Indignation Meeting Summarized: "That this Society will excommunicate any physician who shall teach in the proposed school and anyone else who might even consort with said teachers."

Thus were difficulties placed in the way of women, young or old, who sought professional education in those days, and the Philadelphia episode above quoted was not without its parallels elsewhere.

It is interesting to note, however, that the profession of pharmacy has for over a century and a half found an important place for women in its activities, and more than ever are women interested in scientific pursuits, finding this field of public health fruitful in opportunity.

The first woman pharmacist in the country was Elizabeth Marshall (1768-1836), daughter of the first president of the Philadelphia College of Pharmacy and Science. The silhouette on the cover of this issue is from an authentic miniature of this pioneer in science. Among other women who succeeded her in the study and practice of pharmacy was Clara Marshall, who attended instruction in 1876, and later became dean of the Woman's Medical College of Philadelphia. Susan Hayhurst (1820-1909), who received her degree in 1883 from the College, later took an active part in practical pharmacy and hospital service. Grace Lee Babb Abbott, of the class of 1884, earned prominence as a member of the faculty in chemistry of the Woman's Medical College. From then on, women continued in the classes in pharmacy, on a scholastic plane equal to that of the male students, and attained positions of prominence which have in many cases earned

them recognition and reward through honors from learned scientific and professional institutions through the world.

In the average pharmacy class of today, 12 per cent. of the students are women—unabashed, unafraid, earnestly seeking the knowledge with which to succeed in the world. Most of those who enter pharmacy do so because of a love for the profession gained through previous contacts, such as service in a pharmacy or by some family connection. Others enter solely as a means to a definite goal to be reached by a collegiate degree in pharmaceutical subjects.

At the completion of their college careers, there is first of all, retail pharmacy, wherein women find a definite place. Nursing and the practice of medicine, preceded by the sound basic course of study in pharmacy, hold a definite and worthwhile future for women students. Hospital pharmacy service provides a large outlet for women graduates. A considerable proportion of them have been actively identified with pharmaceutical association work of local, state and national scope, sometimes achieving to important offices in these organizations. Research work claims many women after graduation, as do numerous other allied vocations.

Others have engaged in teaching in pharmaceutical and medical institutions, and still others are serving as clinical technicians, chemists, in manufacturing pharmacy, and in sanitation work, and other sciences related to public health. Their proficiency has been amply demonstrated and the great majority have attained striking success.

And so, from the facts contained in these paragraphs, it can be seen that there are definite opportunities for women in pharmacy. In research work, in the solving of pharmaceutical and chemical problems, and in like situations, women have particular competencies for certain duties. Beyond the ability and the training necessary, women have a certain intuitive facility for doing certain things and doing them well. Women have had, and have now, a growing place in pharmacy.

IVOR GRIFFITH.

PHARMACY WEEK — OCTOBER 20th TO 26th

ONCE again the attention of our country is directed to the profession of pharmacy by the observance of Pharmacy Week.

This year as never before the pharmacist should assume a new responsibility. The moral obligation to his profession has always served as a motive for impressing upon the public the service rendered in the interests of public health. But now the added cause of patriotism should provide a two-fold reason for a careful review of his ability to render the service that he is qualified to give.

It would seem that it becomes the duty of every pharmacist to prepare himself in every possible way to be in a position to function in the most efficient manner to improve the health of those whom he serves either now, or later, in any emergency that may arise.

The importance of pharmacy during the stress of war-time conditions is recognized in England where pharmacy is listed on the schedule of reserved occupations. Pharmacists in this country may be called upon to render a type of service far more comprehensive than today. Let us be ready to serve and serve well. L. F. T.

ORIGINAL ARTICLES

A TOXICOLOGICAL INVESTIGATION OF CERTAIN ALKALOIDS

Bernardo A. Acena * and L. Wait Rising **

FORENSIC medicine places a great responsibility upon its practitioners. So often the evidence they present in legal encounters results in the sacrifice of human life to the end that justice shall be consummated. Frequently this evidence has to do with the destructibility of a poison in contact with body tissue long since dead. Testimony based on chemical findings in such instances should be weighed against data collected in a laboratory under conditions where some or all of the toxicologically important variables were controlled. Such data scientifically collected under conditions analogous to those in forensic medicine but with the advantage of complete historical chronology are necessary to properly fortify or discredit presented evidence.

Control or comparison data of this nature referring specifically to the stability of poisons under a variety of toxicological conditions after death is scarce. The most recent extensive contributions to the field have been those of Rising and Lynn (1) and Wilson and Rising (2). The work herein described was designed to extend the accumulation of knowledge in this direction.

Five poisons were chosen for the study. They were cocaine hydrochloride, strychnine sulfate, hydrastine hydrochloride, atropine sulfate and brucine sulfate. These were mixed with minced stomachs of freshly killed sheep and then exposed to certain of the physical and chemical influences which might affect their stability and existence under a variety of toxicological situations.

Experimental

Preparation of samples: Each of the poisons was prepared by mixing it in 100 milligram portions in four-ounce wide-mouth bottles with 50 grams of minced sheep stomach. Groups of six bottles of each poison were treated with 150 cc. portions of single preservatives commonly used for that purpose in toxicological work. Those selected were 95 per cent. ethyl alcohol, saturated solution of arsenic trioxide,

*In charge of Agricultural Chemistry Section, Plant Utilization Division, Bureau of Plant Industry, Department of Agriculture and Commerce, Commonwealth of the Philippines.

**Professor of Pharmacy, University of Washington, College of Pharmacy.

4 per cent. solution of formaldehyde, 1 per cent. solution of mercuric chloride, and a widely-used embalming fluid. All were sealed and stored in the laboratory at temperatures varying from 20 degrees to 25 degrees C. In addition, two sets of six samples of each poison were made up without benefit of preservative. One set was left open and exposed to the elements, and the other sealed.

Sets of blank-biologic samples were also prepared in the same manner, and were used as controls for the alkaloid-biologic specimens. Sets of non-biologic alkaloidal solutions were prepared too, using each of the five preservatives and a water solution. Each cubic centimeter of these alkaloidal solutions contained five milligrams of the alkaloidal salt. The controls were stoppered, labeled, and stored under the same conditions as the alkaloidal-biologic preserved specimens.

Method of extraction: The general procedure for extracting the alkaloids was as follows: The alkaloid-biologic sample was made acid with a 5 per cent. solution of tartaric acid, and transferred into a casserole. The container was washed several times with small portions of 95 per cent. ethyl alcohol until the volume of the washings was approximately 50 cc. This was mixed well, and placed on a water bath at a temperature of 40 degrees to 50 degrees C. to allow the alcohol to evaporate. Several cubic centimeters of Jacques Loeb's* (3) solution was then added to the specimen to prevent the dissolution of the precipitated protein and at the same time to precipitate the protein that was not precipitated by the alcohol. This was allowed to macerate before being strained through a piece of cheese cloth. More of the solution was used for washing. The total volume of the strained solution was close to 250 or 500 cc. The liquid was allowed to stand for a few hours to complete the precipitation of the protein substances, then filtered through a pleated filter paper, washing the filter paper several times with a small portion of Jacques Loeb's solution. The clear filtrate was transferred into a 250 or 500 cc. volumetric flask and made to volume.

An aliquot of 50 cc. of the solution was transferred to a separatory funnel, and to it was added a few cubic centimeters of tartaric acid solution to insure its continued acidity. This was defatted by shaking it several times with 25 cc. portions of ether. After the removal of the fatty material, the solution was made alkaline with 10 per cent. ammonium hydroxide or with a saturated solution of sodium

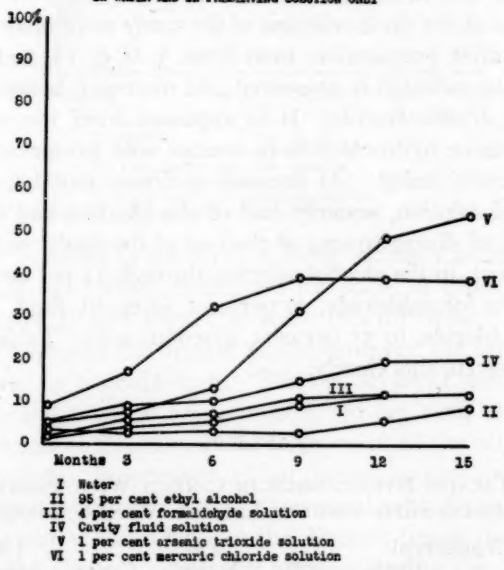
*The solution is a mixture of 8 cc. of $CaCl_2$ and 10 cc. of NaCl, each of which is 8 molar in strength.

TABLE I

STABILITY OF COCAINE HYDROCHLORIDE IN CONTACT WITH WATER AND PRESERVATIVE SOLUTIONS ONLY

Type of Solution — Water Time in Months	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
			Per cent. Recovery		
0	98.8	98.1	99.1	96.7	96.6	91.5
3	96.5	98.1	95.6	91.9	92.5	83.2
6	95.7	97.7	93.0	90.2	87.1	78.0
9	91.0	97.8	89.3	85.6	69.1	61.8
12	88.3	94.3	88.6	80.3	51.0	61.7
15	88.2	91.5	88.5	80.1	46.6	61.7

FIGURE 1
RATE OF DECOMPOSITION OF COCAINE HYDROCHLORIDE IN WATER AND IN PRESERVING SOLUTION ONLY



I Water
II 95 per cent ethyl alcohol
III 4 per cent formaldehyde solution
IV Cavity fluid solution
V 1 per cent arsenic trioxide solution
VI 1 per cent mercuric chloride solution

bicarbonate in the case of hydrastine hydrochloride, as this alkaloid was found to be thus more soluble in the organic solvent. Then the alkaloid was extracted with chloroform, using 25, 25, 15, 10 and 5 cc. of the solvent. Ordinarily it was not necessary to make more than five extractions to completely remove the alkaloid.

The alkaloid-chloroform extract was filtered through a small filter paper and evaporated to a small bulk, then shaken with 10 cc. of 10

per cent. ammonium hydroxide to purify the extract. The purified chloroform-extract was transferred into a 50 cc. tared beaker and evaporated to dryness. The residue was dried to a constant weight in an electric oven at a suitable temperature, weighed and reported as the pure recovered alkaloid. In reporting the percentage recovery of the alkaloid, the weight of the recovered alkaloid was divided by the weight of the alkaloid calculated from the original salt. The quotient multiplied by 100 gives the percentage as reported in the tables.

The blank-biologic control was treated and analyzed in accordance with the general procedure mentioned above. In all cases any weight derived from the stomach tissue was subtracted from the weight of the dried alkaloidal material. The non-biologic controls were determined quantitatively in the same manner as the others.

The analyses, in order to determine the stability or permanence of the poisons under the conditions of the study were made on samples immediately after preparation, then those 3, 6, 9, 12, and 15 months old. The data collected is presented and discussed below.

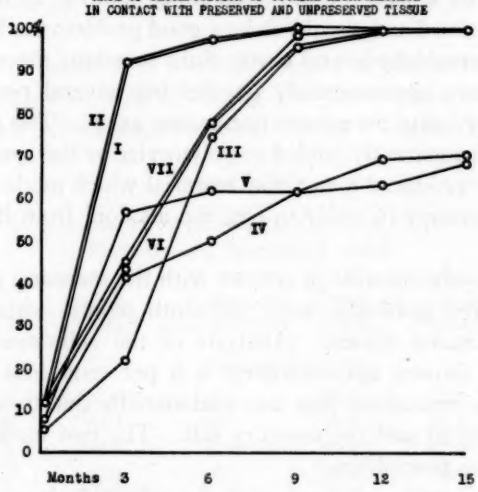
Cocaine Hydrochloride: It is apparent from the experimental work that cocaine hydrochloride in contact with preservative solution only is relatively stable. At the end of fifteen months, even in the arsenous acid solution, scarcely half of the alkaloid had disappeared. The per cent. of disappearance at the end of the study varied in order from 9 per cent. in the alcohol solution through 11 per cent. in water, 12 per cent. in formaldehyde, 20 per cent. in cavity fluid, 38 per cent. in mercuric chloride, to 55 per cent. arsenous acid. Table I and Figure I demonstrate this clearly.

TABLE II

STABILITY OF COCAINE HYDROCHLORIDE IN CONTACT WITH PRESERVATIVE SOLUTIONS AND MINCED SHEEP STOMACH, AND ALSO WITH UNPRESERVED TISSUE

Type of Solution—Time in Months	Unpreserved		95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
	Exposed	Unexposed					
	Per cent. Recovery						
0	92.2	92.2	94.7	93.6	91.3	89.6	89.4
3	7.3	8.9	79.2	59.2	43.8	57.9	55.6
6	3.5	3.2	25.8	50.9	39.2	21.5	22.2
9	0.0	0.0	3.9	38.7	38.7	1.5	3.9
12	0.0	0.0	trace	31.2	36.5	0.0	0.0
15	0.0	0.0	0.0	30.7	30.2	0.0	0.0

FIGURE 2
RATE OF DECOMPOSITION OF COCAINE HYDROCHLORIDE
IN CONTACT WITH PRESERVED AND UNPRESERVED TISSUE



I Unexposed
II Exposed
III 95 per cent ethyl alcohol
IV 4 per cent formaldehyde solution
V Cavity fluid solution
VI 1 per cent arsenic trioxide solution
VII 1 per cent mercuric chloride solution

Organic material in the form of sheep stomach added to the preservative solutions greatly accelerated the speed of dissociation of the alkaloid. Table II and Figure II show this difference. Here, as in the specimens without the organic tissue, however, the rate was appreciably retarded by formaldehyde. The two series of samples containing this chemical retained approximately 30 per cent. of the original poison at the end of fifteen months; whereas in all the other series the salt had completely disappeared within twelve months, and in the case of the unpreserved sample, it had dissociated within nine months.

In the water solution without the stomach tissue, the rate of dissociation of the alkaloid was fairly uniform during the fifteen-month period. This data disagrees with the findings of Sandolin (4) who reports that when a solution of cocaine hydrochloride was kept at room temperature, practically all of the decomposition occurred during the first month.

In alcohol, the amount of dissociation of the alkaloid was also very low. One peculiarity of the dissociation is the fact that during the first nine months the disappearance curve is almost level, from

which time there was a gradual upturn which continued to the end of the study. The reason for the sudden acceleration in decomposition was not determined and should make a good problem for further study.

In the formaldehyde and cavity fluid solutions the curves of disappearance were approximately parallel but several per cent. apart, with the cavity being the poorer preserving agent. The formaldehyde in both liquids apparently tended to polymerize as the specimens stood. This tendency produced a wax-like material which made an additional extraction necessary in order to free the alkaloid from its contaminations.

Cocaine hydrochloride in contact with the mercuric chloride solution disappeared gradually until the ninth month, after which time further dissociation ceased. Analysis of the solutions immediately upon mixing showed approximately a 9 per cent. loss in alkaloidal content. This immediate loss was undoubtedly due to a reaction between the alkaloid and the mercury salt. The two formed a voluminous, flake-like precipitate.

In contact with arsenous acid, the alkaloid slowly disappeared over the fifteen-month period so that at the end of the study slightly over half of the cocaine had disappeared. The rate of disappearance was comparatively slight for the first six months. It speeded up materially for the next six months, then slackened off.

Cocaine in contact with sheep stomach alone, regardless of whether the specimen bottles were sealed or unsealed, disappeared with extreme rapidity. At the end of three months more than 90 per cent. of the alkaloid had dissociated in both cases. During the next six months the curve of dissociation sloped gradually to the point of complete disappearance. Nine months after the first analysis, no alkaloid could be demonstrated in either series of samples. In the unsealed series the biologic material dried and hardened to such a degree that extraction was possible only after the material had been soaked for at least two days in a 5 per cent. solution of tartaric acid. The fate of the cocaine so lost should be worked out.

Cocaine in contact with sheep stomach and alcohol as a preservative dissociates rather slowly for the first three months. From that time on dissociation is rapid and regular until six months later, when the last vestige of alkaloid had disappeared.

The disappearance of the alkaloid in contact with sheep stomach and either mercuric chloride or arsenous acid was also complete nine

months after the initial analysis. Compared to the alcohol-preserved specimens, however, the curves of disappearance were more nearly straight lines.

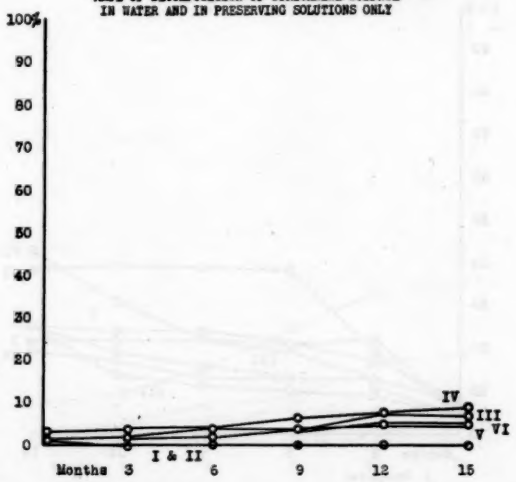
The two formaldehyde solutions were the best preserving agents from the point of view of retarding the dissociation of the alkaloid when in contact with sheep stomach. In both series, the rate of dis-

TABLE III

STABILITY OF STRYCHNINE SULFATE IN CONTACT WITH WATER AND PRESERVATIVE SOLUTIONS ONLY

Type of Solution — Water		95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
Time in Months			Per cent. Recovery			
0	100.0	99.9	98.3	98.3	98.3	97.7
3	99.9	99.9	98.2	98.2	97.9	96.7
6	99.9	100.0	97.5	96.1	97.4	96.3
9	99.9	99.9	96.5	95.3	96.9	93.5
12	100.0	99.9	94.6	92.2	95.8	92.3
15	99.9	99.9	94.5	92.3	95.3	91.5

FIGURE 5
RATE OF DECOMPOSITION OF STRYCHNINE SULFATE IN WATER AND IN PRESERVING SOLUTIONS ONLY



I Water
II 95 per cent ethyl alcohol
III 4 per cent formaldehyde solution
IV Cavity fluid solution
V 1 per cent arsenic trioxide solution
VI 1 per cent mercuric chloride solution

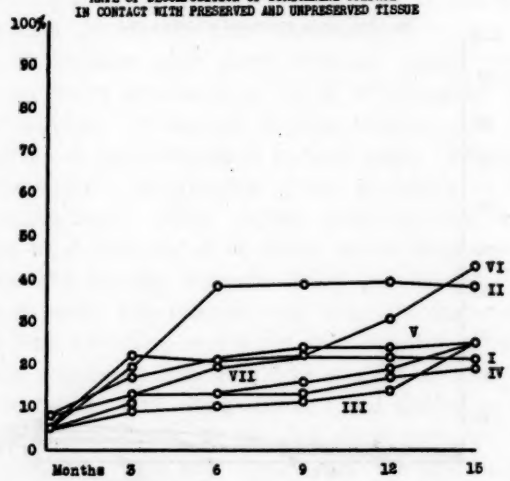
sociation of the cocaine was approximately the same. The two curves crossed approximately nine months after the initial analysis, but at the end of fifteen months both met at a point indicating about 70 per cent. loss. In these samples, as was the case with the alkaloid-preservative solutions containing formaldehyde, extra extractions were necessary in order to free the alkaloid from products of polymerization.

TABLE IV

STABILITY OF STRYCHNINE SULFATE IN CONTACT WITH PRESERVATIVE SOLUTIONS AND MINCED SHEEP STOMACH, AND ALSO WITH UNPRESERVED MATERIAL

Type of Solution—Time in Months	Unpreserved—Exposed	Unpreserved—Unexposed	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
				Per cent. Recovery			
0	95.3	95.3	94.6	95.7	92.3	94.2	94.4
3	80.6	78.3	90.3	89.0	82.4	87.8	87.8
6	62.1	79.4	90.0	87.2	78.5	80.1	87.5
9	61.1	78.3	88.7	86.3	75.8	78.4	84.6
12	61.2	78.3	86.1	83.2	76.0	69.2	81.2
15	61.7	76.2	75.0	80.7	75.6	57.6	75.6

FIGURE 4
RATE OF DECOMPOSITION OF STRYCHNINE SULFATE IN CONTACT WITH PRESERVED AND UNPRESERVED TISSUE



I Unexposed
II Exposed
III 95 per cent ethyl alcohol
IV 4 per cent formaldehyde solution
V Cavity fluid solution
VI 1 per cent arsenic trioxide solution
VII 1 per cent mercuric chloride solution

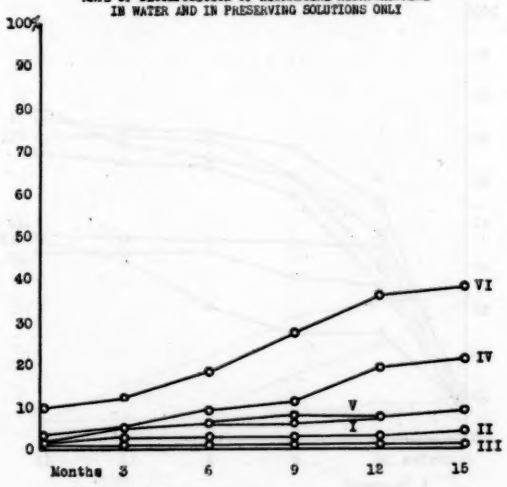
Strychnine Sulfate: Tables III and IV demonstrate clearly the stability of the alkaloid under most conditions of toxicologic interest. It is, however, apparently not as indestructible as many have previously thought. By the end of fifteen months an appreciable loss or disappearance of the poison had developed in those samples containing sheep stomach. Figure IV shows this depreciation clearly.

TABLE V

STABILITY OF HYDRASTINE HYDROCHLORIDE IN CONTACT WITH WATER AND PRESERVATIVE SOLUTIONS ONLY

Type of Solution — Time in Months	Water	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
			Per cent. Recovery			
0	97.4	97.9	98.9	96.5	98.9	90.9
3	94.1	97.4	98.6	94.8	97.9	87.8
6	93.9	97.5	98.3	90.2	95.9	81.6
9	93.1	97.5	98.4	88.1	91.7	72.4
12	92.8	96.5	98.2	80.8	91.6	63.5
15	91.7	95.0	98.3	78.5	91.2	61.5

Figure 5
RATE OF DECOMPOSITION OF HYDRASTINE HYDROCHLORIDE IN WATER AND IN PRESERVING SOLUTIONS ONLY



I Water
II 95 per cent ethyl alcohol
III 4 per cent formaldehyde solution
IV Cavity fluid solution
V 1 per cent arsenic trioxide solution
VI 1 per cent mercuric chloride solution

Hydrastine Hydrochloride: This alkaloid is reasonably stable when in contact with water, alcohol, formaldehyde or arsenic trioxide. Cavity fluid and mercuric chloride solutions, on the other hand, are poor preservatives if the solutions are to be kept any length of time.

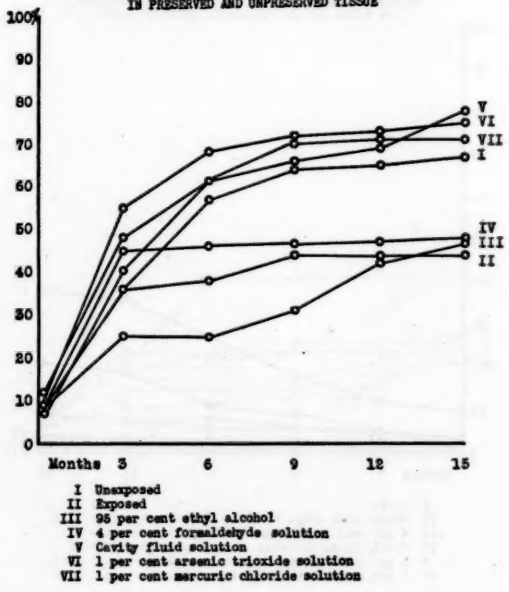
Sheep stomach seems to catalyze the disappearance of the poison. The decomposition is sufficiently accelerated so that in all the cases

TABLE VI

STABILITY OF HYDRASTINE HYDROCHLORIDE IN CONTACT WITH PRESERVATIVE SOLUTIONS AND MINCED SHEEP STOMACH, AND ALSO WITH UNPRESERVED TISSUE

Type of Solution—Time in Months	Unpreserved Exposed	Unpreserved Unexposed	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
	Per cent. Recovery						
0	90.6	90.6	92.8	92.4	93.2	92.6	88.7
3	64.2	64.8	75.5	54.8	59.8	45.0	51.6
6	61.5	42.3	75.3	54.2	38.1	31.9	38.8
9	55.9	36.4	68.4	53.8	29.0	28.5	33.4
12	55.3	35.1	57.1	52.3	28.6	26.3	30.7
15	55.4	32.3	52.6	51.5	29.3	24.0	21.9

FIGURE 6
RATE OF DECOMPOSITION OF HYDRASTINE HYDROCHLORIDE IN PRESERVED AND UNPRESERVED TISSUE



I Unexposed
II Exposed
III 95 per cent ethyl alcohol
IV 4 per cent formaldehyde solution
V Cavity fluid solution
VI 1 per cent arsenic trioxide solution
VII 1 per cent mercuric chloride solution

studied, within fifteen months 45 per cent. or more of the drug had disappeared.

The losses, under the conditions of the investigation, are shown in tables V and VI and Figures V and VI.

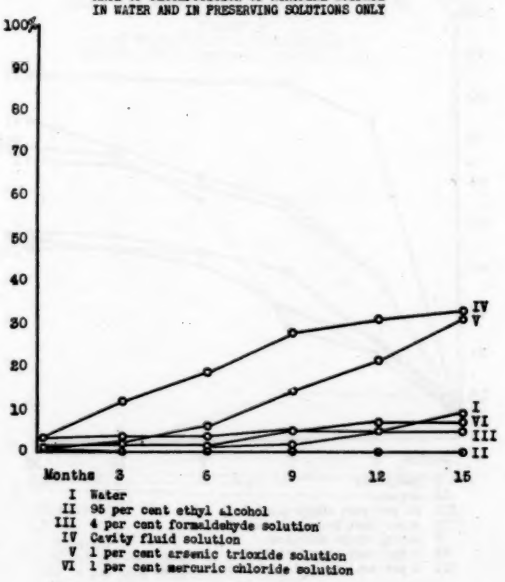
Atropine Sulfate: Relative stability in aqueous and alcoholic solutions, in contact with 4 per cent. formaldehyde and 1 per cent.

TABLE VII

STABILITY OF ATROPINE SULFATE IN CONTACT WITH WATER AND PRESERVATIVE SOLUTIONS ONLY

Type of Solution — Water Time in Months		95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
			Per cent. Recovery			
0	99.4	99.8	99.3	97.5	99.4	98.3
3	99.1	99.9	99.1	88.6	98.1	96.9
6	99.2	99.8	97.8	81.2	94.6	95.5
9	98.2	99.8	94.5	71.8	85.3	94.8
12	94.9	99.8	94.4	68.9	78.3	92.7
15	91.5	99.8	94.4	66.3	68.6	92.7

FIGURE 7
RATE OF DECOMPOSITION OF ATROPINE SULFATE IN WATER AND IN PRESERVING SOLUTIONS ONLY



I Water
II 95 per cent ethyl alcohol
III 4 per cent formaldehyde solution
IV Cavity fluid solution
V 1 per cent arsenic trioxide solution
VI 1 per cent mercuric chloride solution

mercuric chloride solutions was demonstrated by this alkaloidal salt. In the presence of cavity fluid and 1 per cent. arsenic trioxide solutions, depreciation, particularly in the latter months of the study, was greater.

None of the samples in contact with tissue displayed any degree of permanence. The most marked deterioration in these specimens occurred in the exposed unpreserved samples. In all cases at the end of fifteen months the maximum alkaloidal content remaining in any

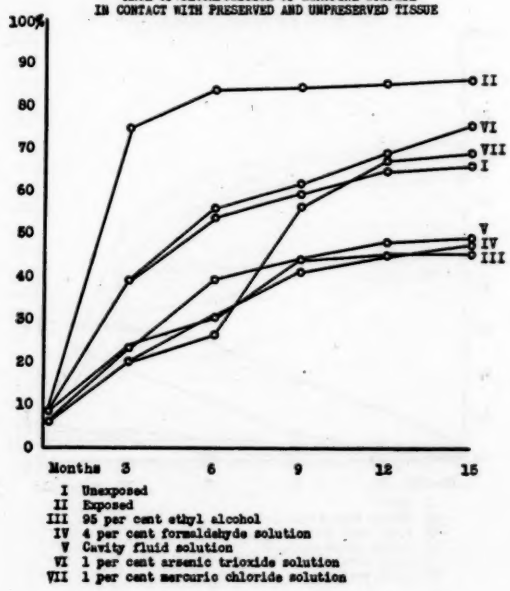
TABLE VIII

STABILITY OF ATROPINE SULFATE IN CONTACT WITH PRESERVATIVE SOLUTIONS AND MINCED SHEEP STOMACH, AND ALSO WITH UNPRESERVED TISSUE

Type of Solution—Time in Months	Unpreserved—Exposed	Unpreserved—Unexposed	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
				Per cent. Recovery			
0	93.9	93.9	92.7	94.5	94.9	93.8	94.9
3	25.0	60.8	76.5	80.1	77.9	60.4	80.7
6	15.6	45.7	70.2	69.0	60.2	49.4	73.3
9	15.0	40.5	56.4	58.3	55.3	38.1	42.6
12	14.8	36.1	54.8	54.6	51.8	30.8	32.8
15	13.8	33.3	54.2	51.5	50.7	23.4	30.1

FIGURE 6

RATE OF DECOMPOSITION OF ATROPINE SULFATE IN CONTACT WITH PRESERVED AND UNPRESERVED TISSUE



I Unexposed
II Exposed
III 95 per cent ethyl alcohol
IV 4 per cent formaldehyde solution
V Cavity fluid solution
VI 1 per cent arsenic trioxide solution
VII 1 per cent mercuric chloride solution

specimen was 54.2 per cent. Figures VII and VIII and Tables VII and VIII show the entire picture of deterioration so far as this study was concerned.

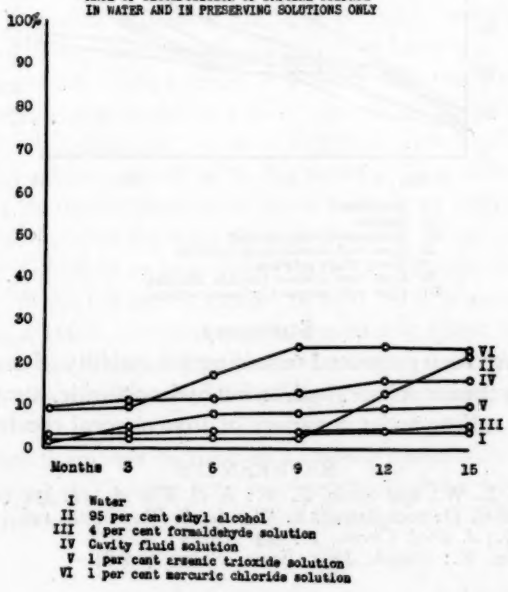
Brucine Sulfate: The recovery of appreciable quantities of brucine sulfate apparently may be expected under most toxicological conditions even many months after its first contact with biologic material. In simple solution with preservative only its disappearance rate is even slower. Tables IX and X and Figures IX and X delineate the limits of deterioration of the poison during the study.

TABLE IX

STABILITY OF BRUCINE SULFATE IN CONTACT WITH WATER AND PRESERVATIVE SOLUTIONS ONLY

Type of Solution — Time in Months	Water	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
			Per cent. Recovery			
0	97.2	98.4	98.9	91.8	98.5	92.8
3	96.9	98.1	98.0	89.5	96.3	90.8
6	96.8	97.9	97.6	88.6	92.2	83.7
9	96.9	98.0	97.1	87.3	92.1	76.2
12	96.3	87.8	96.8	84.3	90.8	77.7
15	96.3	78.8	95.8	84.0	90.4	77.4

FIGURE 9
RATE OF DECOMPOSITION OF BRUCINE SULFATE IN WATER AND IN PRESERVING SOLUTIONS ONLY



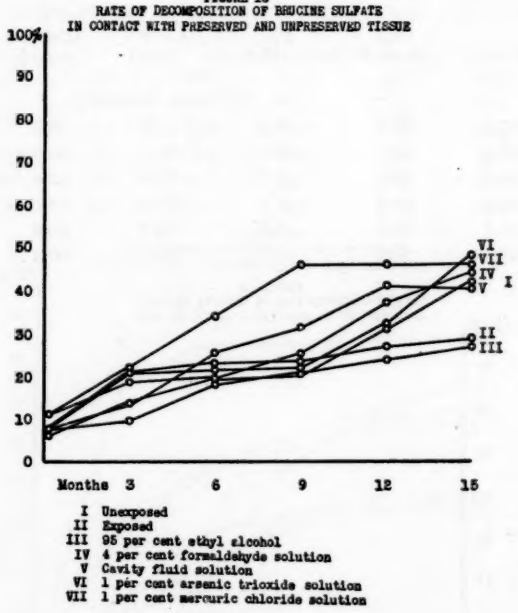
I Water
II 95 per cent ethyl alcohol
III 4 per cent formaldehyde solution
IV Cavity fluid solution
V 1 per cent arsenic trioxide solution
VI 1 per cent mercuric chloride solution

TABLE X

STABILITY OF BRUCINE SULFATE IN CONTACT WITH PRESERVATIVE SOLUTIONS AND MINCED SHEEP STOMACH, AND ALSO WITH UNPRESERVED TISSUE

Type of Solution—Time in Months	Unpreserved—Exposed	Unpreserved—Unexposed	95% Alcohol	4% Formaldehyde	Cavity Fluid	1% Arsenic Trioxide	1% Mercuric Chloride
	Per cent. Recovery						
0	92.2	92.2	93.8	94.0	89.9	93.5	90.7
3	80.0	81.1	90.4	85.2	86.4	79.2	78.0
6	77.5	80.7	81.6	80.9	74.9	78.8	66.6
9	76.3	80.5	79.2	74.7	68.8	78.0	53.8
12	72.8	68.2	75.1	62.1	59.2	67.4	53.6
15	71.8	57.7	72.8	55.9	58.8	51.8	53.6

FIGURE 10
RATE OF DECOMPOSITION OF BRUCINE SULFATE IN CONTACT WITH PRESERVED AND UNPRESERVED TISSUE



Summary

Data have been presented regarding the stability of cocaine hydrochloride, strychnine sulfate, hydrastine hydrochloride, atropine sulfate, and brucine sulfate under a variety of toxicological conditions.

REFERENCES

1. Rising, L. W., and Lynn, E. V.: *J. A. Ph. A., 21,* 334 (1932).
2. Wilson, C. O., and Rising, L. W.: *J. A. Ph. A., 28,* 146 (1939).
3. Loeb, J.: *J. Biol. Chem., 31,* 343 (1917)
4. Sandolin, E.: *Dansk. Tids. Farm, 2,* 309 (1928).

A SUGGESTION FOR A U. S. P. TEST FOR OLIVE OIL TO ELIMINATE TEASEED OIL

By Wallace H. Dickhart

IT WAS in 1933 that the writer first applied to vegetable oils the Lieberman-Burckhard test which is described in Simon's Physiological Chemistry 1901, as follows: "If a small amount of cholesterin is dissolved in about 2 cc. of chloroform and is treated with ten drops of acetic acid anhydride and subsequently with concentrated sulphuric acid, the solution at first assumes a red color then a blue and finally a green. The latter develops at once if cholesterin is present only in traces." At that time the above test was modified to read: 5 cc. of olive oil dissolved in 5 cc. of chloroform to which was added 0.05 cc. of acetic anhydride and to this mixture was added 0.05 cc. con. sulphuric acid, which was permitted to slide down the test tube very slowly, so as to form a ring test. A brown ring formed changing to red then blue to green. Teaseed oil gave a deep red ring changing to green. This method was found to be unsatisfactory because extracted olive oil foots which had been refined and bleached, also produced a deep red ring changing to green. Hence for the time being this modification was discarded.

Since that time Filtelson, in 1935 or 1936, working along the same line of thought produced what is now known as the Filtelson test for teaseed oil. His method is to place in a test tube 0.80 cc. of acetic anhydride and to this is added 1.50 cc. of chloroform and then 0.20 cc. of con. sulphuric. The mixture is shaken and then seven drops of oil added, which is to be tested. The mixture is again shaken and the tube placed in a water bath at 25 degrees C. After about seven minutes the tube is placed in ice water and 10 cc. of ethyl ether (distilled over sodium) added. Teaseed oil produces a red color. When the test is applied to olive oil it is sometimes necessary to run a blank, for comparison, containing about 8-10 per cent. teaseed oil in an olive oil that showed a negative result, on account of certain types of olive oil will produce a color of approximately this percentage.

This small amount of color in certain types of olive oil has been quite annoying and I have been experimenting for a long time to try to find a method by which we could eliminate this color reaction in

pure olive oil. Therefore I suggest the following method to be tried out, which has been working satisfactorily for me.

Method—Place 1 cc. of acetic anhydride in a test tube; to this is added 2 cc. of chloroform and 0.20 cc. of con. sulphuric acid and shake, then let stand for about three minutes. When the temperature is about 40 degrees C. drop in ten drops of the olive oil. Shake and then quickly add 0.10 cc. of phosphoric acid (U. S. P. 85 per cent. syrupy) and again shake. Place in a water bath at 23-25 degrees C. and let it stand for ten to fifteen minutes. After which add 5 cc. of ethyl ether (distilled over sodium). Transfer to ice water and allow to stand until the color forms. Teaseed oil produces a red color and olive a bluish green for all types. This method should detect as low as 10 per cent. teaseed oil in olive oil. Now after the red color of the teaseed oil has faded out, add 1 cc. of acetic anhydride and twenty more drops of the oil which has been tested. Then carefully slide down the test tube 2.6 cc. of con. sulphuric acid forming a ring test, after the ring has formed, cautiously and slowly mix. Then allow to stand about one minute and place in water to cool. When cold, add 5 cc. more of ethyl ether (distilled over sodium) and then place back in the water bath at 25 degrees C. The red color of the teaseed oil will reappear and the olive green color for olive oil which was first formed will return. The returned red color of the teaseed oil will remain sometimes as long as two hours before fading out.

Best results are obtained with C. P. reagents free from alcohol and water. Use special C. P. acetic anhydride.

The olive oil used in the above experiment showed about 8 per cent. standard teaseed oil in olive with the Filtelson method, while no color with my suggestion.

In my opinion U. S. P. olive oil should not give a red color under these conditions.

THE ACTION OF HIGH FREQUENCY SOUND WAVES ON BACTERIA

By Donald P. LeGalley* and George W. Patterson**

THE original purpose of this set of experiments was to make a thorough investigation of the killing action of high frequency sound on some of the commonly found bacteria. The frequency used was 8900 cycles, which is in the high audible region, and the power input furnished to the radio oscillator was approximately 250 watts. The oscillator was a magneto-striction type using a hollow nickel tube as the source of vibrational energy. A glass tube containing the material being irradiated was connected to the nickel tube by a rubber connection as shown in Fig. 1.

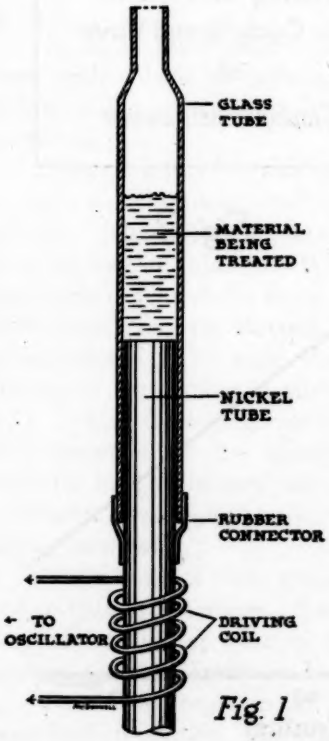


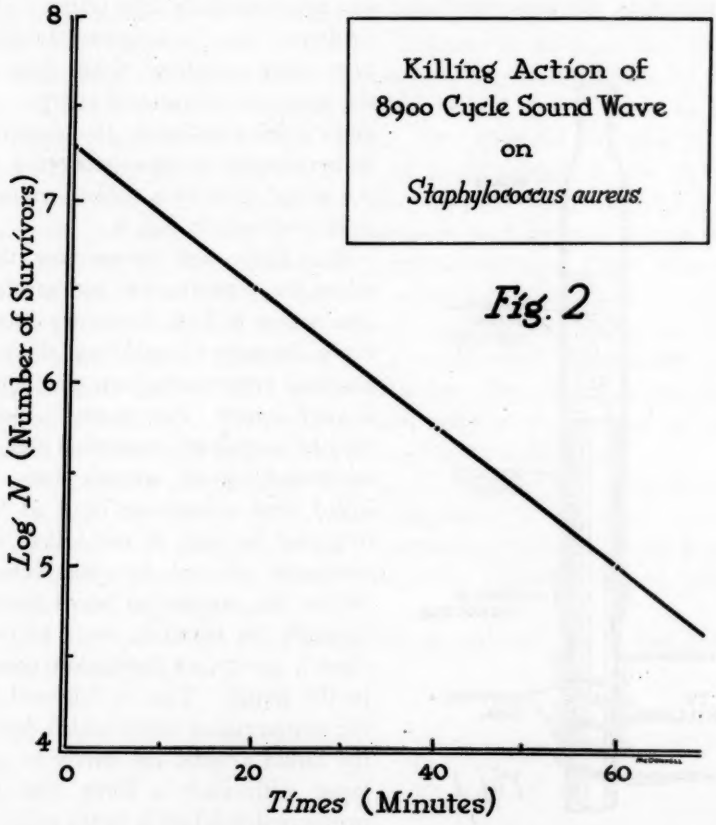
Fig. 1

It is fairly well known now, that when the compression and rarefaction waves of high frequency sound travel through a liquid, that the mechanical treatment given the liquid is very severe. For example, blood may be coagulated, materials may be emulsified, small animals may be killed, and animals as large as the frog and the fish, if not killed, are seriously affected by this action. When the rarefaction wave travels through the liquid it tends to produce a cavity, or cavitation occurs in the liquid. This is followed by the compression wave which forces the liquid around the cavity to collapse with such a force that the pressure developed is in the order of magnitude of thousands of pounds to the square inch.

*Assistant Professor of Physics, Philadelphia College of Pharmacy and Science.

**Assistant Professor of Bacteriology, Philadelphia College of Pharmacy and Science.

It has been found by others that this powerful mechanical action of alternate low pressure followed by extremely high pressure at the rate of 8900 times per second has a killing action on certain bacteria. (1), (2), (3). The object of this set of experiments was to test this killing action, to determine the killing rate, and to see whether or not this method could be used, practically, to produce sterility in those commercial products which are affected by heat sterilization, and which cannot be treated with disinfectants.



With this in mind the first experiment was performed by studying the killing action on standard cultures of Staphylococcus aureus by irradiating them with high frequency sound. (The term "standard" refers to the strain employed which is that used in the F. D. A.

technique of the Phenol Coefficient Test.) This organism is recognized in bacterial standardization and in the testing of disinfectants. It was also used because it is the most representative of the commonly observed bacteria as to resistance to external agents, and furthermore it would allow us to compare our work with that of other investigators who employed the same organism.

In the first attempt 24-hour-old boullion cultures were diluted with physiological normal saline and irradiated 1, 2, 3, 4 and 5 hours. After irradiation 1/10 cc. portions were transplanted into beef extract broth to see if growth resulted or if sterility had been produced. After incubation for 24 hours at body temperature all transplants showed growth.

In many other determinations on this organism, where counts were made only at the beginning and at the end of irradiation, definite killing action was observed, but at no time was a sterile product produced.

This work was followed by an experiment to determine how many bacteria were killed by irradiating the suspension for different periods of time. This involved planting in agar, and counting the colonies after 48 hours incubation. When a curve was plotted with the log of the number of survivors along the ordinate and the time of irradiation in minutes along the abscissa, a graph similar to that shown in Fig. 2 was secured. This graph shows a straight line relationship between the log of the number of survivors (N) and the time of irradiation (T), or that the killing rate varies exponentially with time, and can be represented by the equation $N = N_0 e^{-\mu T}$ where (N) represents the number of survivors after (T) minutes of irradiation, (N_0) represents the original number of bacteria, and (μ) represents the killing coefficient.

A total of 4 of these graphs have been made by carefully plating and counting the bacteria. They all proved to obey this same straight line relationship, at least up to 120 minutes of irradiation, with an average slope of .0408.

Tests were made in an attempt to study the effect of longer periods of irradiation. Bacteria which were irradiated up to 120 minutes were plated and the colonies counted as just described. Those irradiated for longer periods of time revealed the following interesting observations:

The slope of the curve dropped off from the constant value, indicating that the killing rate was less. Those colonies formed in suspensions irradiated longer than 120 minutes were unusually small and appeared as pin points, making it almost impossible to count them. The longer the irradiation was allowed to continue the smaller were the colonies developed from these suspensions, and they finally became indistinct and difficult to see with the naked eye. Microscopic examination of these small colonies after they had been stained revealed organisms which when compared with those not irradiated were very irregular in shape and displayed a marked variance in size. All this points to the possibility that the growth of the organisms in all probability was affected by continued irradiation.

Two other types of bacteria, the commonly found B. coli, and the spore-forming B. subtilis, were also treated with high frequency sound in the same manner as the Staphylococcus aureus. It was suggested that if the high frequency sound could successfully attack two of these three types of bacteria, that it would be possible to apply this method to practical sterilization.

After plating and counting the colonies surviving the irradiation of high frequency sound for different periods of time, curves were secured for B. coli similar to those secured for the Staphylococcus aureus. The only difference that was noted was that the slope of the curve, or the killing rate, was less for the B. coli than for the Staphylococcus aureus. (.0271 against .0408.) This indicated that the sterilizing action of high frequency sound on B. coli is not as rapid as on the Staphylococcus aureus.

Practically the same thing happened when the spore-forming bacteria B. subtilis were irradiated by the high frequency sound. After irradiating the suspension for 30 minutes the number of bacteria per cc. was reduced from 648,000 to 3,000. This represents a killing action comparable to that on the other two species of bacteria.

After irradiating and counting these three bacterial suspensions the conclusion was reached that although there was a definite killing action in each case, that sterility was not produced, and cannot be produced until a more powerful oscillator can be secured. The 10 watts output of this oscillator does not compare with the thousands of watts which probably go into an autoclave. A more powerful oscillator is being planned with which it is hoped that a study of the problem can be continued.

We wish to express our appreciation to Dr. Joseph Rosin, Vice-President of Merck and Co. who furnished the funds for this research, to Dr. E. Fullerton Cook, Chairman of the Revision Committee of the U. S. Pharmacopœia for his active interest in the project, and to Dr. Louis Gershenfeld the head of the Bacteriology Department who was consulted frequently, and who gave advice and counsel freely. The apparatus was loaned to us by the Johnson Research Foundation of the University of Pennsylvania, through the courtesy of Dr. Chambers, and Dr. Bronk the director.

REFERENCES

1. Some Effects of Intense Audible Sound on Living Organisms and Cells. Chambers and Gaines. *Jour. Cellular and Comparative Physiology,* Vol. 1, No. 3, June, 1932.

2. Resistance of Viruses of Poliomyelitis, Human Influenza, and Swine Influenza to Intense Sound Vibration. Scherp and Chambers. *Proc. Soc. Experimental Biology and Medicine,* Vol. 35, page 495, 1936.

3. The Bactericidal Effects of High Frequency Sound. Williams and Gaines. *Jour. Infec. Diseases,* Vol. 47, page 485, 1930.

ABSTRACTS FROM AND REVIEWS OF THE LITERATURE OF THE SCIENCES SUPPORTING PUBLIC HEALTH

Report by the Council on Pharmacy and Chemistry on the Chemotherapy of Syphilis by the Massive Dose Intravenous Drip Method. *J. A. M. A. 115,* 857 (1940). In 1939 Chargin, Leifer and Hyman (*Am. J. M. Sc. 197,* 480 (1939)) reported the results of a 5 year period of observation on twenty-five patients with early syphilis treated in 1933 by means of an intravenous drip therapy given in the form of solutions of 4 gm. of neoarsphenamine over a course of 5 days. Five of these patients were not followed beyond the fifth month of the first year. The remaining twenty all showed complete serologic reversals though five were not followed a sufficient time for satisfactory observation. Fifteen were examined on or about the fifth year. Eleven of these had repeatedly negative Wassermann reactions. Two of the fifteen had become reinfected with syphilis. The results of this study were so promising that a further study on eighty-six men was undertaken the average dose being slightly in excess of 4.1 gm. and the duration of treatment slightly less than five days. The clinical results were quite parallel, sixty-seven of those adequately followed showing complete seroreversal.

Due to the importance of this problem a Committee on Massive Drip Intravenous Therapy was formed representing several public health and other organizations. This committee has since made available an outline of massive dose chemotherapy of early syphilis. It is pointed out that certain toxic reactions do frequently occur and these are discussed.

Mapharsen has been found superior to neoarsphenamine and a large number of cases are recorded in which it was used. The dose of mapharsen employed was 0.24 gm. a day for five days.

The Council points out the great significance from the standpoint of public health of this new departure in syphilis therapy particularly since it permits the rapid sterilization of early contagious syphilis. However, in view of the frequency of toxic reactions, some of them grave in type, the Council believes a conservative attitude of the

medical profession to be advisable. It is felt that this form of syphilis therapy although of great interest is still in the experimental stage and should be confined to those institutions organized to conduct this project on a recognized experimental plane. L. F. T.

Preparation of Nessler's Reagent. A. P. Vanselow. *J. Ind. Eng. Chem. Anal. Ed. 12,* 516 (1940). Disconcerting experiences with Nessler's reagent prepared with formulas found in textbooks and the literature include slowness in the development of color, formation of a red precipitate, and the development of off colors especially with a low concentration of ammonia. The author has investigated the reasons for these disturbing factors and has formulated a Nessler's reagent that is satisfactory in every respect. The formation of a red precipitate is explained by a consideration of the Dunningham phase-rule diagram for the three component system potassium iodide-mercuric iodide-water. At least a 5 per cent. excess of potassium iodide is needed to prevent this red precipitate upon dilution.

The color formation with ammonia is very strikingly slowed up by increasing amounts of excess potassium iodide but increasing amounts of potassium hydroxide overcome this effect and speed up the color formation. These effects are most noticeable with low concentrations of ammonia.

The author taking in consideration all factors recommends the following formula: The reagent should have 10 moles of potassium hydroxide for each equivalent of mercuric ion in solution with 5 per cent. excess of potassium iodide over and above that called for by the hypothetical compound potassium mercuric iodide. Furthermore, it should stand several days before being used to permit any precipitate to settle out. It is recommended that 45.5 gm. of mercuric iodide and 34.9 gm. of potassium iodide be dissolved in as little water as needed, 112 gm. of potassium hydroxide (140 cc. of an almost saturated solution, sp. gr. $\frac{15^\circ}{4^\circ}$=1.538) added and the whole diluted to 1 liter. This solution is 0.2 N. with respect to mercury content. In the Nessler test, 5 cc. of this reagent to 100 cc. of final volume are used and the color comparisons with the standards are made 30 minutes after mixing. L. F. T.

Determination of Phenolphthalein in Tablets. G. Thomas. *J. Pharm. Belg. 21,* 361 (1939) through *Quart. J. Pharm. & Pharmacol. 13,* 175 (1940). The presence of other substances in tablets of phenolphthalein render the usual methods proposed for its determination unsuitable. The following method is claimed to give satisfactory results. The tablets are extracted with acetone in a Soxhlet apparatus. After removal of the solvent the phenolphthalein is dissolved out from the impure residue with a known volume of N/10 sodium hydroxide and the solution filtered. An aliquot portion of the filtrate is acidified and the phenolphthalein extracted with ether. The ethereal solution is washed with water and after removing the ether the residue is dried and weighed. L. F. T.

Disinfection of Books—*Hospitalstidende,* Feb. 24, 1940 through *The Prescriber 34,* 178 (1940). The results of a series of experiments on the disinfection of books are reported. The experiments were carried out in an electric drying apparatus fitted with a highly sensitive thermo-regulator. From forty to fifty years' old books were used in the experiment. It was found that 55 degrees C. was the lowest temperature insuring certain death of all staphylococci. Those inside the books, curiously enough, were killed more rapidly than those on the covers and backs of the volumes. This was probably due to the high degree of moisture occurring inside the books during the evaporation of the water absorbed by them. It is suggested that a temperature of 60-65 degrees C. should be employed as this is certain to meet every possible condition. Staphylococci placed between the pages of old books can keep alive for months whereas they are rapidly destroyed when placed between the pages of new volumes. This difference is thought to be due to the effect of the volatile substances released by the paper and printing ink which in old books have evaporated more or less completely. L. F. T.

Interference of Iron Rust on Benzidine Test. O. Glemser. *Ber. deuts. chem. ges. 72,* 1613 (1939) through *Quart. J. Pharm. & Pharmacol. 13,* 180 (1940). In order to determine whether the pres-

ence of rust interferes with the benzidine test for blood seven different modifications of iron oxide were tested for their action on benzidine. Only one FeOOH gave a negative result. Since some of the other modifications are liable to be present in rust it is evident that the benzidine test is not reliable in the presence of rust. L. F. T.

A New Color Reaction for Cocaine. E. Percs. *Ber. u. pharm. ges. 15,* 449 (1939) through *Quart. J. Pharm. & Pharmacol. 13,* 174 (1940). A few milligrams of cocaine is mixed with 2 drops of nitric acid and 15 drops of sulfuric acid in a test tube which is placed in a boiling water bath for five to ten minutes. The solution is then cooled and mixed with 1 cc. of water; a canary yellow coloration is produced. On shaking the solution with acetone after the addition of 2.5 cc. of caustic soda solution diluted with an equal volume of water, the acetone layer assumes an azure blue color. Of the other local anesthetics only delcaine, alypin and the eucaines give a similar reaction. A number of alkaloids, aromatic hydrocarbons and phenylbarbiturates when tested by this reaction impart characteristic colors to the acetone. L. F. T.

The Chemical Examination and Standardization of Magnesium Trisilicate. H. Surfleet and G. V. Porter through *Quart. J. Pharm. & Pharmacol. 13,* 109 (1940). Magnesium trisilicate was introduced into medicine in 1936 as an improved antacid and adsorbent. Since that time several papers have appeared relating to the methods of analysis of this substance. The authors in this paper endeavor to place the essential properties of this substance in correct perspective and to set forth more accurate methods of analysis.

The special clinical value of magnesium trisilicate lies largely in its application to the continuous control of acidity in the stomach. For this purpose it has been found more suitable than any other of the many magnesium silicates surveyed. Its theoretical formula

$Mg_2S_3O_8.2H_2O$ requires a gravimetric ratio for $MgO : SiO_2$ of 1 : 2.24. This ratio is important if satisfactory clinical results are to be obtained although from a practical manufacturing point of view the tolerance allowed should be between the limits of 1 : 2.21 and 1 : 2.28.

The only means of establishing the identity of magnesium trisilicate with certainty is by the use of X-ray diffraction photographs. The difference between magnesium trisilicate (pure sepiolite) and an undeterminate mixture of silicates, free silica, and free magnesia is readily detected since the magnesia has its own characteristic X-ray diagram. The magnesia may be present as a gross impurity and yet pass unrecognized by chemical analysis. The X-ray method, however, requires expensive apparatus and a special technique. When this method is not feasible a carefully conducted schematic chemical analysis together with tests for *total* antacid power and *lag* in acid neutralization will yield valuable information concerning the nature of the material. The method must be accurate and some of the published methods are not sufficiently exact even for routine purposes.

Methods for the examination of magnesium trisilicate are presented including loss on ignition, silica, magnesium, total antacid value, initial and lag antacid value, adsorptive value, arsenic and lead content.

A genuine sample of magnesium silicate should have in addition to the correct gravimetric ratio of $MgO : SiO_2$ as stated above powerful neutralizing action with a characteristic lag. The total antacid power should be not less than 300 cc. of N/20 hydrochloric acid per gram (ignited weight) and the lag value should be approximately 50 per cent. of the total antacid power.

Adsorptive power should show lag as well and the total adsorptive value should be not less than 240 mgm. of methylene blue per gram of ignited weight. L. F. T.

Bottle-Capping Compounds With Glycerin

Notwithstanding the extensive current usage of cellulosic caps and bands, manufacturers, pharmacists, laboratory workers and others frequently find that easily-made bottle capping compounds are widely

useful to produce neat looking and efficient results. One simple compound of this kind, given in *Drug and Cosmetic Industry* consists of:

Glycerin	2 oz.
Liquid phenol	½ drachm
Water	8 oz.
Powdered gelatin	4 oz.

Mix the first three ingredients and pour onto the gelatin. Heat on a water bath until dissolved. Beautiful tints can be obtained by adding water-soluble aniline dyes.

This sealing composition is said to have withstood show-window temperatures as high as 170 degrees F. without losing color or running and is so balanced that it will dry quickly and not crack on drying. The caps form a neat finish and cut like rubber. They can be waterproofed by dipping into a weak formaldehyde solution. To apply, liquefy the mass by heating (a water bath is best) and dip the closure and neck of the bottle into the preparation. The best dipping temperature is about 110 degrees F.

BOOK REVIEW

Done by persons, unafraid to upbraid, but perfectly willing to give praise where praise is really due.

Introduction to Materia Medica and Pharmacology. (Second Edition. By H. A. McGuigan, Ph. D., M. D., Professor of Materia Medica, Pharmacology and Therapeutics, University of Illinois, College of Medicine and R. A. McGuigan, M. D., C. M., with Elsie E. Krug, B. S., R. N. 845 pages plus index, 39 text illustrations and 38 color plates. C. V. Mosby Co. Price $3.50.

Although intended primarily by the author as a text for schools of nursing, this book is so constituted as to be of value as a reference book in pharmacy. The first portions of the text dealing with pharmaceutical procedures and chemical theory are very elementary but probably no more so than is occasioned by the fact that it is directed chiefly to student nurses.

That part of the text devoted to materia medica and pharmacology is written in an exceptionally clear and understandable style with a decided emphasis on what constitutes a practical working knowledge. The authors are to be commended on the comprehensive inclusion of both official and non-official drugs which are of importance.

In conclusion the book can be recommended to both pharmacists and students of pharmacy for the refreshing and somewhat different aspect in which this subject is presented.

L. F. TICE.